SCIENCE NEWS-LETTER

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FIRST JOB OF NEW FUEL

Cornstalk Gas Fries Its First Egg

(See page 283)

Vol. XVI No. 448

Is There an Ether?

Physics

Science still must answer the great and fundamental question: "Is there an ether?" And despite the many feats of the Einstein theories of relativity in explaining and predicting observed facts of physics, such as the way the planet Mercury moves in its orbit, they are seriously menaced by having one of their foundations pulled out from under them.

For Prof. Dayton C. Miller has reported to the Optical Society of America that he has during the past year laboriously repeated the ether drift experiments that he has been making during the last nine years in a Cleveland laboratory and on high Mount Wilson in California.

Again he finds an observed effect in the light path of his apparatus such as would be produced by a relative motion of the earth and the ether of about ten kilometers (six miles) per second. This is the same result that Dr. Miller has obtained during the past few years. In 1925 his paper on this work won the annual prize of the American Association for the Advancement of Science. This continued ability to obtain the same results over a period of years, whether the apparatus is at normal level in Cleveland or on a California mountain, makes Dr. Miller's results all the more important.

Nor does Dr. Miller feel that his experiments repudiate the famous Michelson-Morley experiments on ether drift performed in 1887. Prevalent opinion holds that this historic test showed that there is no ether drift, that there is no something filling all space, and it was upon this interpretation that Prof. Albert Einstein based his special theory of relativity when he enunciated it in 1905. But Dr. Miller, studying the results of his latest experiments performed this year on the campus of the Case School of Applied Science, only about 300 feet from the location of the original Michelson-Morley interferometer of 1887, finds that his results showing the solar system moving through space "fully agree with and confirm the original Michelson-Morley observations, although the present interpretation is different."

In the 1887 Michelson-Morley experiment there was discovered a slight difference in the time that it took light to travel over two paths, one at right angles to the other. But this was attributed to experimental errors, to those slight deviations that enter into all observations. Dr. Miller, by performing hundreds of experiments and by improving the details of the ether-drift interferometer, has by his results demonstrated that the observational differences of the original experiments and his many later tests are real and not due to error in the apparatus. Such refinements as shock-absorbing pads on the supporting piers and extreme precautions to eliminate temperature differences were taken in this year's experiments. The interferometer uses the interference of light waves to measure far more accurately than any mechanical means. Dr. Miller's instrument gives numerical results reliable to the hundredth part of a wave-length of light, although the length of the light path is 130,000,000 wave-lengths. He can detect a relative motion of earth and ether a twentieth of that which he actually observed.

The discovered motion of six miles a second is not a merely earthly phenomenon, but a cosmic one. It is fixed with relation to sidereal time; that is, it is toward a fixed place in space. The earth and its millions and the whole solar system is rushing, Dr. Miller declares, "toward the point having a right ascension of 17 hours."

How are the scientists to reconcile with their theories this well-tested motion that the ether-drift experiments demonstrate? Dr. Miller says: "It seems impossible at the present time to account for a cosmic effect of this small magnitude and it will be necessary to continue these experiments and to coordinate them with others before an acceptable theory can be propounded."

Science News-Letter, November 9, 1929

In This Issue

To Study Mayas

Anthropology

A combined scientific and educational expedition has left for the little known territory of Quintana Roo, last stronghold of Maya Indian tribes who have never submitted to outsiders.

The party is headed by Moisés Saenz, of the Mexican Ministry of Public Education, and its purpose is to study the actual social and economic conditions of that territory. Rural schools have been established all over Mexico in the last eight years, but Quintana Roo resists. Of three Indian chiefs who divide the territory among themselves to govern, only one has cooperated with federal officials in their educational campaign.

Another has enriched himself immensely on chicle which is sold to foreign merchants, and it is claimed that with his feudal power over his subjects he blocks progress. The region is wealthy to an unknown degree in chicle, Mexican cedar, and mahogany. It is for the most part unmapped, and existing maps are claimed to be largely wrong, because villages move about and are not now at the same places where they were when the last sketchy maps were made.

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Making Gas from Cornstalks

Chemistry

By Frank Thone

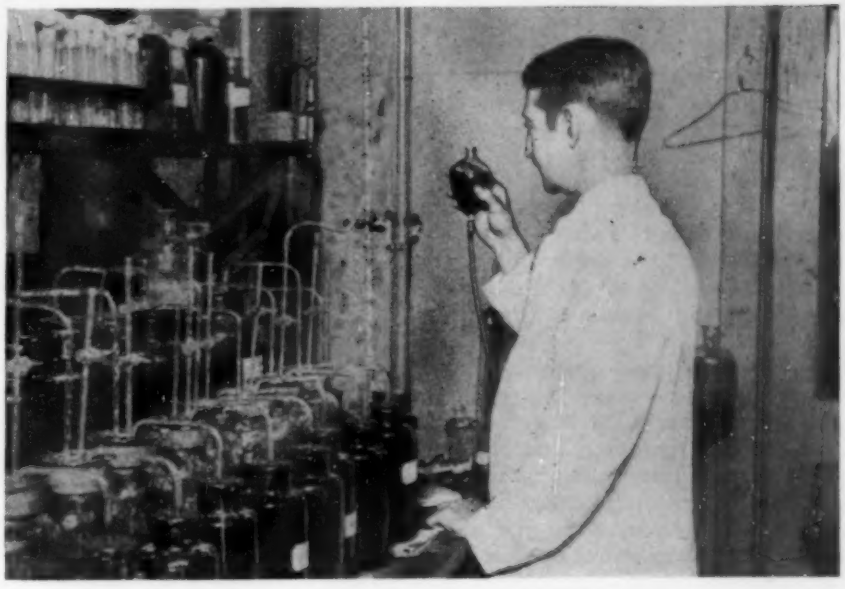
In the good old days when the gas light suddenly began to flicker we would send Johnny downstairs to put another quarter into the meter. But now John, somewhat more grown up, will probably be asked to go out behind the barn and shovel in a few more pounds of ground-up cornstalks.

For this is chemistry's newest contribution to the problem of farm relief—making gas for cooking, lighting and industrial uses from the hitherto despised cornstalk, the most conspicuous waste produced on millions of acres of midwestern and southern farm lands. At the Minneapolis meeting of the American Chemical Society a short time ago a brisk and energetic professor of chemistry from the University of Illinois, Dr. A. M. Buswell, told how he and one of his research students, C. S. Boruff, have succeeded in producing paying quantities of methane, a gas of high fuel value, from nothing more costly than cornstalks, water and sewage sludge.

The thin cornstalk porridge is dumped into a tight-topped tank, the digested sludge product added, and the bacteria in the sludge do the rest. They ferment the cellulose in the cornstalk pith into two gases, methane and carbon dioxide. The former is of value as a fuel and the latter has a host of industrial uses. Compressed until it becomes a liquid, it is sold to soda fountains and soft-drink factories, to become the "fizz" in pop and soda-water. Still further condensed, it becomes an extremely cold frosty-looking solid now widely used under the name of "dry ice" for refrigerating purposes.

But it is the methane that the two Illinois chemists are really after. Methane is the same stuff that is known to coal miners as firedamp. To them it is a deadly menace, for it is odorless, and without their knowing it they may run into a place where it is sufficiently concentrated to ignite and cause a disastrous explosion. Methane also occurs naturally in wet and boggy places, arising in bubbles from decaying vegetation under the water. In such places it is known as marsh gas. When it takes fire, as it frequently does, marsh gas burns with those eerie flames known for ages as the will-o'-the-wisp or *ignis fatuus*.

For many generations methane was known only as a product of nature, useless or even dangerous. But when men came to light their houses and cook their food with gas, they discovered that this same stuff was in the pipes that brought their fuel. Common illuminating gas is a complex mixture of a number of substances, and methane is one of them. If there were more methane in the gas we buy from the gas companies we might like it better, because according to Prof. Buswell's calculations a 50-50 mixture of methane and carbon dioxide gives almost as much heat as coal gas. And all the heat in the mixture comes from the methane, for carbon dioxide has no value whatever as fuel. Methane, therefore has a higher fuel value than an equivalent amount of coal gas.



C. S. BORUFF measuring the output of cornstalk gas in the laboratory at Urbana

The discovery that this valuable fuel can be fermented out of cornstalks has come more or less as a by-product of Prof. Buswell's work on getting gas from city sewage. Prof. Buswell's regular job is with the Illinois State Water Survey. From the work of earlier chemists he knew that disposal plants give off considerable quantities of methane, which can be used for heating and lighting. This looked promising; perhaps towns could get their gas supplies from their own wastes. But a further quantitative study showed that only enough gas for one-fifth of the population of a given community could be had by the most efficient possible handling of its entire sewage.

The difficulty lay in the amount of material available for the bacteria whose fermentative activities produce the gas. There were plenty of the "bugs", but the city waste did not give them enough stuff to work over into methane and carbon dioxide. Wasn't there some other waste lying about that could be thrown into the tank and used by the willing micro-organisms?

The most obvious waste in the middle west is cornstalks. The farmer has to raise about a dollar's worth of stalk for every dollar's worth of corn he harvests, but until recently he couldn't sell that dollar's worth of cornstalk for a cent. Aside from what he could feed his livestock as silage or rough dry fodder, he had to let the rest go as a dead loss. Stalks were of minor value as fertilizer even when they were plowed under.

Of recent years a number of researchers have been seeking possible industrial uses for cornstalks, and a few promising outlets for the product have been developed. Prof. O. E. Sweeny at the Iowa State College at Ames has made a good grade of wall-board out of the stalk fiber, as well as a substitute for the ground cork used in insulating refrigerators. At Danville, Ill., a few miles from Prof. Buswell's laboratory at Urbana, the first factory in America for the production of paper pulp from cornstalks has been (*Turn to next page*)

Making Gas from Cornstalks—*Continued*

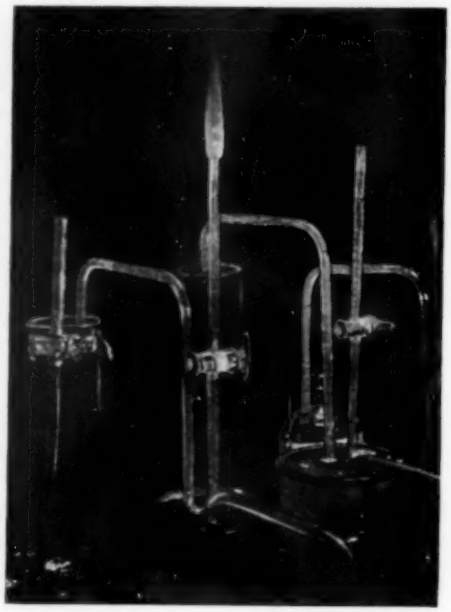
built and is now operating. But even when these industries have reached their fullest development they will account for only a small fraction of the total cornstalk production of the middle west. There will still be cornstalks to burn.

Prof. Buswell decided to see whether they couldn't be burned, at a profit. For chemical science has become very much Yankee-minded during the past generation or two, and likes to look for eventual dollars and cents at the bottom of its test tubes.

There was no good chemical reason why bacteria should not make good fuel gas out of cornstalks as well as out of sewage. Cornstalks are made pretty largely out of cellulose, which is a complex chemical arrangement of carbon, hydrogen and oxygen. For methane one needs only carbon and hydrogen; the oxygen is gratuitous, really in the way, something to be got rid of. The bacteria of decay that live in sludge are able to split cellulose apart in such a way that half of the carbon hooks up with all of the hydrogen to form the methane, and the other half takes on all of the oxygen to form the carbon dioxide. The second half of the carbon in the cellulose therefore becomes simply a sort of chemical dump-wagon to cart off the troublesome oxygen.

So much for the chemical theory with which Prof. Buswell started. Like all theories, it had to be tested. The apparatus which he and his assistant Mr. Boruff rigged up in their laboratory does not look much like the gleaming and mysterious arrays of glass traditionally supposed to be the equipment of chemists. On the contrary, it looks very decidedly "haywire". A row of wide-mouthed brown bottles, hooked up to a second row of bottles with glass tubing through their stoppers, a few glass stopcocks to let out the gas when you want a sample—that is about all there is to it. Inside the brown bottles a mess of ground-up cornstalk soaking in water, with bubbles rising to the top every now and then.

Those unexciting-looking bubbles are really the exciting part of the whole business. They are the products of the breathing of the bacteria, and they are made partly of the same carbon dioxide that we ourselves let go of when we breathe, but partly also of that very useful fuel gas, methane. Certain kinds of bacteria have the ability to breathe without



A FLAME of cornstalk gas

free air. They get their oxygen by breaking down compounds in which it is combined. In the present case, they get it from its prison in cellulose. But such bacteria can combine oxygen with other chemical elements only so far as the oxygen goes; and if there are any other elements left over after such airless breathing they have to be let go "as is" or turned into other compounds which do not contain any oxygen. In the present instance the bacteria combine the oxygen in the cornstalk cellulose with the carbon as far as it lasts, and then take the leftover carbon and combine it with hydrogen before letting it go. That is why we get methane as part of the product. If there were enough oxygen to go around all we would get would be more carbon dioxide, plus water. The success of the work depends on keeping the bacteria without an air supply.

The bacteria ask wages for this work, but after all they are very low wages. The heating value of the gas produced is six and two-thirds per cent less than the amount theoretically possible from the cellulose. The bacteria take that much for their work, as old-time millers used to exact as toll a certain fraction of the grain they ground.

Cellulose is the daily bread of these bacteria. In addition, they also demand their daily meat. They must have something containing nitrogen, which is not present in cellulose. Nitrogen might be given them in the form of various nitrate salts, or as ammonia, or in a number of other chemical products. But a much cheaper source can be found in the various disagreeable stuffs we lump together under the malodorous name of sewage. This is rich in nitrogen, and the bacteria, having no noses and no imaginations, take to it like so many pigs. Prof. Buswell suggests that when his method of gas-making is once established in small, one-farm plants all the waste products of both cornfield and house can go into the same tank, to emerge after fermentation as good clean cooking gas.

After Prof. Buswell and Mr. Boruff had settled to their satisfaction that methane could be generated from cornstalks in their array of glass bottles, they proceeded to work on a slightly larger scale. They had a small sheet-metal tank made, modeled on the ones which Prof. Buswell had already been using successfully in his sanitary work. But it was still of laboratory size; a couple of feet high, suitable for operation on a chemist's workbench. They called it the "iron stomach". As it stands in the laboratory at Urbana there is something of the "haywire" flavor about it also, for they haven't taken the trouble to get it nicely nickel-plated or enameled; and the collecting tank consists of a wooden keg with a big glass bell-jar inside, perched on an old packing-box. But this "iron stomach" digests cornstalks and produces methane, and that's the essential thing.

Now there is a larger "iron stomach", in a rough wooden shed a little distance away from the university campus. This one is on a real gas-making scale; it should turn out enough methane to keep the average family gas stove burning. It is eight feet in diameter and about ten feet high, though half its height is sunk into the ground. The top part is cylindrical, and the bottom slopes, funnel-fashion, to a point. The left-over stuff settles down into the bottom of this funnel, whence it can be removed by a pump. To keep the cornstalk mass from wadding into a solid lump, there is a second pump, which removes water from the middle of the tank and squirts it back in at the top and side when necessary thereby preventing clogging.

Prof. Buswell has done some figuring on the (*Turn to next page*)

Pan-American Highway Nearly Finished

Engineering

Less than 120 miles of roadway is all that will remain unopened at the end of 1929, of the new Pan-American highway between Laredo, Texas, and Mexico City, it is reported by the National Highway Commission of Mexico.

It is now possible to go from Laredo, via Monterey, to Ciudad Victoria, capital of Tamaulipas, and by the end of the year the road will be open to traffic, though not completed, as far as Valles, in the state of San Luis Potosi. Working north from Mexico City, the road is now open to Zimapan, state of Hidalgo, and by the end of the year, automobiles will be able to go as far as Jacala, a point farther north.

The portion between Valles and Jacala is being saved for 1930, as it is the most difficult part of the road of a very mountainous region, which will require much engineering to bring through.

South of Mexico City, the Pan-American highway goes through Puebla, a sector that is already complete, but from there on no official work has as yet been carried on. Work, however, will be begun on this southern sector in 1930. The road will lead from Puebla south to Huajuapan, and from there to the city of Oaxaca, an inaccessible region much broken up by mountains.

From Oaxaca, the road leads to Tehuantepec on the isthmus of that name, and from there to Tuxtla Gutierrez, capital of Chiapas. Then it goes to Tapachula, on the Mexican side of the Guatemala border, through a region of Chiapas but little known.

Road construction was first begun seriously in Mexico in 1925, when four state capitals, Cuernavaca, Toluca, Pachuca and Puebla, were connected with Mexico City. Because the traffic on these roads is heavy, they are largely macadamized, but it is the policy of the Road Commission to produce long mileage at low cost, until traffic is denser.

More than 1200 miles of highway have been opened to motor traffic in Mexico since 1925, and over 21,000,000 dollars have been spent. Gasoline consumption in 1928 was about 212 million liters. Although Mexico is one of the world's leading oil producing countries, gasoline prices are several times higher than in the United States.

A motor trip to Mexico will be of geographical and ethnographic value to the tourist. He will pass through deserts, rich tropical villages, semi-tropical towns at a medium elevation, and then as he approaches the central state of Hidalgo, he will go higher than 10,000 feet, where it is always cold and scrub pine and oak are the only trees.

He will pass through the Huasteca region of Indians that are the puzzle of anthropologists, because they are apparently related to the Maya Indians much farther south. Then in the state of Hidalgo are the Otomies, and around the region of the valley in which Mexico City lies, are the Aztecs. After Puebla comes Huajuapan, where Mixtec is spoken, and farther south near Oaxaca City there are Zapotec towns, while in the state of Chiapas are Indian groups related to the Mayas. Each of these Indian groups has largely retained its own language, though frequently in addition to the national Spanish; and the costume, too, varies as one passes from region to region.

Science News-Letter, November 9, 1929

Making Gas from Cornstalks—*Continued*

gas-producing possibilities of cornstalks on the average farm. He calculates that a ton of stalks will yield from ten to twenty thousand cubic feet of gas. Taking the lower figure, a ton of cornstalk would furnish gas for 400 people for one day, allowing 25 cubic feet per person per day. In the corn belt, where at least one-third of the land is always in corn, a circle 16 miles in diameter would produce enough stalks to supply a city of 80,000 inhabitants with gas.

Since cities cover a considerable area of ground themselves, the fringe of land about them that would supply their domestic gas requirements would be even narrower than eight miles. So even after the maximum use of cornstalks is attained on the present basis of gas consumption, there will still be great quantities left over. This opens up the possibilities of the development of cheap power in parts of the country not blessed with cheap water power nor underlain with beds of high-grade coal, oil or natural gas. It may be that corn itself will be one of the most potent influences tending toward an industrialization of the corn belt.

There are two other angles to the new corn-gas making process, one agricultural, the other industrial. The dreaded European corn borer spends the winter lurking in old cornstalks and stubble, emerging as a trouble-spreading adult moth only when the weather begins to warm up in the spring. But if the farmer has a good dollars-and-cents reason for clearing his fields of all the stalks he can get, either for fuel for his own house or for sale to the city gas-works, the corn borer will be out of a winter home.

The industrial advantages of the bacterial digestion of cornstalks are of promise to paper makers. Not all of the cornstalk is digested in the tank. The long, tough fibers are left, and they are apparently about as tough and strong when they come out as when they go in. Now this is exactly what the paper manufacturer wants. The short, crackly cells of the pith are more or less nuisances to him; the bacteria can have them and welcome. But the long fibers, which the bacteria do not want, can be washed, fluffed out, and then compacted into high-grade writing and print paper.

Cornstalks are not the only material that may be handled to advantage by the bacterial digestion method. One of the largest manufacturers of wall-board has already expressed his interest in the method as a possibility in the working of sugar cane bagasse, which is his raw material. Sugar cane is much like cornstalk in its structure—a thick, pith-filled grass stem with numerous fibers running through it. This manufacturer thinks that he may possibly be able to get gas for power in his factory from the pith cells, which are at present more or less in his way, and then use the power to press into wall-board the residue of the stalks from which it came.

The old boast of the Chicago packer, that "we use all of the pig except the squeal", now bids fair to be equalled by the cornstalk chemist, who will utilize all of the stalk except the rustle of its leaves.

Science News-Letter, November 9, 1929

Canadian Indians Live By Hunting

Anthropology

By JOHN M. COOPER

Dr. Cooper is professor of anthropology at the Catholic University of America.

When the white man first came to what is now the eastern United States, the Indians he met east of the Mississippi and south of the Great Lakes lived mostly the life of primitive farmers, their chief staple being corn or maize as ours is wheat. North, however, of a line formed roughly by the St. Lawrence, the Ottawa, and Lakes Huron and Superior, the forest Indians were and are of markedly simpler culture, being among the lowliest on the whole American continent.

These far northern tribes were strangers to the hoe and digging stick. They grew no maize or beans or squash as did their neighbors to the south, but lived, as they live today, chiefly upon the flesh of moose and caribou, of deer and bear, and of the smaller furred and finned and feathered denizens of the woods and waters. A few wild berries and roots helped vary their diet just a little. They were nomad hunters then. They are nomad hunters still, without trace of agriculture of any kind. In so far, they are living today on about the same lowly culture level on which lived many thousand years ago our own early prehistoric European ancestors of the caves and river drifts.

They have no villages, no roads, no domestic animals, except the dog. Travel is by canvas or birch bark canoe in summer, by snowshoes and toboggan in winter. Until recent years the toboggan, now drawn by dogs, used to be drawn by manpower. Many families or whole bands still live winter as well as summer in primitive conical or loaf-of-bread shaped bark wigwams. These flimsy shelters are made of a framework of poles covered with overlapping rolls of birchbark, an opening being left at the top to let out the smoke. In these wretchedly draughty lodges the natives live through the bitter cold of winter, when the mercury often goes down to forty or fifty or sixty degrees below zero. Heavy blankets and coats of woven strips of rabbit skin help a little, but not enough. And inured as the northern Indian is to exposure and hardship, he suffers keenly from the piercing winter cold.

His whole culture is marked by extreme simplicity. Simplicity of culture is, however, one thing. Stupidity and savageness are quite another. The northern Indian is neither stupid nor savage. Far from it.

In his life work, his trade of hunting and trapping, he is an expert whom few white men can equal. He has an intimate knowledge of the surrounding animal and plant life. In addition he has well established social institutions built upon his hunting life.

During the winter, which is not yet ended in northern Canada, the Indians are scattered all over the wilderness in little isolated family groups. They are not, however, scattered at random, nor do they hunt and wander at will. Each tribe has its own well defined tribal territory, and each family has its own equally well defined family hunting ground within the tribal territory. The tribal territory may cover an area of many thousands of square miles, while the family hunting ground will ordinarily cover from a hundred to five hundred square miles. The northern woods look like no-man's land to us, for there are no fences or other artificial boundary marks, but in reality the land is as rigidly divided into tribal and family sections as are our own rural districts into townships and farms. And no Indian may trap or hunt, without leave, on another Indian's hunting ground.

The northern Indian can, when he wishes, show foresight. Nor is he lacking in resourcefulness. An illustration may bring home the point.

An Indian of the region north of Lake Superior accidentally dropped an ice chisel through a hole he was cutting in the ice on a lake. The water at the point was about thirty feet deep. The Indian needed that ice chisel and he needed it badly, and he had to think. He did. He knew that it had gone to the bottom and was resting upright, for it was a long pole with a heavy iron-pointed spike at the end. So he took a long piece of fish line and tied a sinker to one end of it. Then he tied another cross line to the fish line a couple of feet from the sinker, and on the free end of this cross line he tied a live fish. He then lowered the whole contraption into the water at the precise point where he had dropped the ice chisel, and left it there for a day. The tied live fish had to swim, and naturally swam in circles and so wound the cross line around the fish line and shaft of the ice chisel. The next day the Indian returned and pulled up fish line, sinker, cross line, fish, and ice chisel, —the cross line being beautifully wound round the shaft of the ice chisel. And this is no fish story. It is an ice chisel story, from real life.

The northern Indians are not saints, it is true, but they are very far indeed from being savage. In the olden times they used to abandon the aged and infirm who could not keep up with the band on the hard winter's trek. Their morals left much to be desired, and in most places do still. But taking these primitive tribes as they stand, they compare quite favorably with their white brethren, if that is not damning them with faint praise.

They are scrupulously honest, except where contact with the white man has spoiled them. You can leave anything you possess anywhere you please for any length of time, and though a hundred Indians pass that way and see your property, they will never think of touching it. In many years among them I have never lost a single article, however insignificant, and I have never taken any special pains to hide or protect my belongings. They just do not steal. It is not their custom. A couple of years ago, in inquiring about their system of child training, I asked an old squaw at Fort Albany on James Bay what would be said to a boy six years old by his parents if they detected him stealing a fish from another family's wigwam. She thought for a brief moment and replied: "A boy six years old would not steal."

They are a kindly and peaceful people, not given to violence. I have never heard of a murder among them. And only once have I ever observed a fight, when they were sober. Even the boys do not fight. For days and weeks we have traveled together, through rain and storm, wind bound and tide bound, poling up rushing rapids, tracking along rocky shores, portaging over swampy trails with packs and canoes grinding on our shoulders, and never yet have I heard a word of impatience nor noted any visible sign of anger or chagrin. Losing one's temper is against their code. It is not done.

Among those they know they are given to much (*Turn to next page*)

Mexico's Race Problems Foreseen

Ethnology

The problems of race and color which have arisen in parts of the United States from the presence of Mexican immigrants are of greater importance than the economic aspects of the situation, in the opinion of Dr. Manuel Gamio, Mexican anthropologist, because they may profoundly influence the destinies of the peoples bordering on the Pacific.

As Dr. Gamio explains, these Pacific peoples fall into three main groups, the White, the Yellow and the Yellow-Brown. To the White group belong the racial majorities of Canada, the United States, Australia, New Zealand and Chile, in addition to the racial minorities of the countries from Lower California to southern Peru and Chile. The Yellow people inhabit China, Japan, Manchuria, Indo-China, and the adjacent islands, while the Yellow-Brown make up the racial majorities in Mexico, Central America, Columbia, Ecuador and Peru.

Because the Asiatic and the native American Indian races are anthropologically very close, spontaneous crossing takes place wherever these groups are in contact, as on the Latin-American coasts where unions of Indians with Chinese and Japanese are frequent. The White race on the other hand, especially the Anglo-Saxon White, is less prone to cross with the Yellow or Yellow-Brown.

Because the White and Yellow groups of the Pacific countries are increasing very rapidly in numbers and strength, while at the same time means of communication are improving, Dr. Gamio believes that sooner or later boundaries must fade and aggressive or peaceful contacts result.

The Indo-Iberic countries which occupy the now sparsely settled regions of Latin America must either become White under intense European immigration, or else form a new Yellow-Brown complex in case of sufficient Asiatic influx.

In case of great future immigration into Mexico of southern Europeans, Mexico would become progressively more White and racial prejudices would become relatively insignificant.

On the other hand, if such European immigration does not invade Mexico wholesale and the native element prevails, racial prejudices will continue and the Americanization of the country will proceed more slowly, that very racial prejudice serving as a barrier in the future as it has in the past.

European immigration never has turned serious eyes to Mexico as it has to the United States and Argentina, primarily because, Dr. Gamio says, Mexico is not a country of great agricultural possibilities, as is indicated by the fact that only from seven to eight per cent. of the land may be readily cultivated. The dry mesetas and deserts of the north have little or no rainfall, and another large portion of the country is mountainous and hard to till, while the fertile tropical coasts are unhealthy and infested with insect pests.

Though rich in raw materials, Mexico is insignificant industrially, offering few opportunities to European artisans and laborers, while these furthermore find it hard to compete with the low standards of living of the native. Nevertheless existing immigration restrictions of the United States and Argentina must eventually divert part of the European immigration streams to Mexico and similar countries, Dr. Gamio believes, although this has not yet made itself felt. The incoming balance of Mexico now amounts to only a few thousand individuals a year.

Science News-Letter, November 9, 1929

Canadian Indians—*Continued*

talk and good-natured banter, and an accident to some one in the party who slips in the water up to his waist will furnish amusement for an hour and a day. Home life is admirable. Between husband and wife there is a very equitable division of labor and a very democratic relationship of equality. Both parents are extremely fond of and affectionate towards their children, and as among most other American Indians, children are rarely or never struck or whipped.

The northern Indians are neither mental prodigies nor moral paragons, but taking them all in all, these gentle, kindly, low-voiced hunters of the Canadian forests are men whom one can be proud to have as friends. To live among them is to both like and respect them. They go to show that simple living can go hand in hand with high thinking, that a very low level of material culture may go hand in hand with a relatively high level of mental capacity and of social and spiritual attainment.

We have no means of knowing directly much about the higher social and spiritual life of our own ancestors of the caves and river drifts. But if we can judge at all from the primitive nomad hunters that still live the material life they lived, the chances are our forebears of the caves and river drifts were fairly decent and intelligent members of the human family.

Science News-Letter, November 9, 1929

It has been found that in Iowa 200 boys and girls in each county are leaving the country for the city every year.

Two-thirds of the young doctors graduated from medical schools in the United States this year held college degrees as well as medical.

The first attempted flight across the Atlantic was undertaken in 1873, in a balloon named the Graphic, which started from Brooklyn and landed in a storm at New Canaan, Connecticut.

Blind Good Listeners

Psychology

Blind persons do not hear better, they simply seem to because they listen harder, Mrs. Winifred Hathaway of the National Society for the Prevention of Blindness told members of the Michigan Educational Institute. The popular belief that blind people have more acuity of other senses, such as hearing and touch, is not exactly correct. The special senses of blind people, aside from sight, are no better in the beginning than those of other people, sometimes not as good. But experience and specialization on the part of the blind persons enable them to make their other senses take the place of sight, so that their senses are better developed than those of normal people. The same thing applies to deaf persons who appear to have much keener vision than normal.

Science News-Letter, November 9, 1929

Although American farmers are milking 4,000,000 fewer cows than they did ten years ago, the volume of milk production is maintained by use of better cows.

NATURE RAMBLINGS

By FRANK THONE

Ichneumon Flies

In a hundred thousand homes all over the country, hopeful young naturalists are bringing in big gray cocoons. In the spring, if all goes well, they will be rewarded by the sight of a miracle of resurrection of the seemingly dead, when a lovely moth or beautiful butterfly comes out of the unpromising leaden-hued shroud.

But in a tragic percentage of cases there is no resurrection; no moth nor any butterfly. After weeks of vain waiting a sympathetic elder may open the cocoon with pointed scissors, only to find the chrysalis inside dead, dry and hollow. If the dissection is made carefully, the corpse will show, somewhere on its shell, one or more tiny holes, like the wounds of the smallest kind of birdshot. And there will be corresponding holes to the outside through the cocoon.

If the failure cocoons have been kept in a box, it may be that one or more small, wasplike insects will be found in it. These are the mischief-makers that have thwarted the expectation of a moth or butterfly to come. They have been inside the cocoon; as a matter of fact they have been inside the chrysalis, feeding on the sleeping insect, battening at its expense, and preventing it from ever awakening.

They are ichneumon flies. Some time during the summer, while the caterpillar was waxing fat and juicy, a darting, nervous mother-ichneumon, anxious from a burden of eggs to be laid, rested briefly on the grub's back. During that moment she slipped an egg under its skin. The egg, hatching, produced a tiny grub that made no trouble for the time being, and did not prevent the caterpillar from spinning himself into his silken cradle in the fall. But after that, it grew apace, turning what was intended for a moth into another generation of ichneumon flies.

Science News-Letter, November 9, 1929

Norway to Save Whales

Zoology

Whales, threatened with extinction through the tremendous expansion of the modern whaling industry, have found a friend in need in Norway, the nation in which about four-fifths of the world's whaling is centered. Recent legislation by the Norwegian parliament represents an impressive example of self-imposed conservation and far-sighted industrial policy, says A. Brazier Howell of the Johns Hopkins Medical School, a lifetime student of whales and their ways, and executive secretary of the Council for the Conservation of Whales.

Under the new act all Norwegian whalers are wholly forbidden to kill the right whale, one of the most valuable of all the great sea mammals and formerly one of the most persecuted. All whale cows with calves are given a similar blanket protection, and calves must also be let alone. The practice of paying whaling crews according to the number of whales taken must be discontinued, and all parts of the animal containing oil must be utilized. Illegal catches are subject to confiscation.

The law further confers taxing powers on the King, the funds obtained to be used in enforcing the legislation and in promoting research fundamental to the whaling industry. The King is further empowered to forbid all whaling in tropical waters.

"This praiseworthy and timely action by Norway should prove a cause for no little elation among those interested in maintaining a commercial supply of whales," comments Mr. Howell. "It should render much easier the task of securing international regulation of whaling."

Science News-Letter, November 9, 1929

Two New Vitamins

Physiology

No less than two new vitamins have recently been discovered by English scientists. Katherine Hope Coward and her colleagues at the Laboratory of the Pharmaceutical Society in London have just published a paper describing a new vitamin which has somehow escaped notice before. Scientists do not yet know whether this new factor is necessary for the human race, but Miss Coward's experiments have proved that it is necessary for the growth of that all-important animal, the experimental rat. No name has yet been given to this vitamin. It has been found in fresh milk, lettuce, grass, ox muscle, liver, and wheat embryo.

The other new vitamin has recently been described by Vera Reader of the Biochemical Department, Oxford University. The original Vitamin B was said to prevent beri-beri. Scientists found later that Vitamin B really consisted of at least two separate factors, and they decided to call them B1 and B2. Miss Reader now has found that in the Vitamin B of yeast there is a third growth factor which is chemically distinct from either of the other two. She suggested the name B3 for this new factor. Like B2, it can be destroyed by heat.

The pellagra preventing factor in foodstuffs, known as P-P, was also once thought to be part of Vitamin B.

Science News-Letter, November 9, 1929

Nerves Like Radio

Neurology

The human nervous system has generally been compared to a telegraph system, but Prof. Louis Lapicque in a recent lecture at the Harvard Medical School has compared it to radio. While connection is important in telegraph or telephone systems, time is the important factor in neuro-muscular relay, Prof. Lapicque discovered, just as wave-length is important in radio.

A series of radio receivers, tuned to different wave-lengths, will get different stations or incoming messages, and so different muscles, tuned at different time standards, will get messages, or stimuli, from different nerves.

When a nerve carries a message from the brain to the muscles of the leg, for example, it is the time factor that causes the nerve to deliver its message to the set of muscles that extends the leg, rather than to the set that draws up the leg.

"Every anatomical element, every kind of cell, reckons time according to a particular standard, say thousandths or perhaps hundredths of a second," Prof. Lapicque said.

If the anatomical connections have the same temporal characteristics, the message will pass smoothly, but if the time factors are different the message will not.

Science News-Letter, November 9, 1929

Eight thousand wild horses were killed in Arizona last year.

Mexico Exploring Aztec Ruins

Archæology

The archaeological activities of the Mexican government will be directed to four distinct points during the coming season, touching four ancient civilizations, the Mayas of Yucatan, the Toltecs of Teotihuacan, the Aztecs at Tenayuca, and the Tarascans in Michoacan.

With the discovery of a great terrace in Chichen Itza, faced with stone death's heads in its entire extent, decorations which make archaeologists hope they may have found the tombs of Maya kings, systematic investigations will be made at the spot as soon as the oncoming dry season permits. With the exception of a burial found by Edward H. Thompson, former American consul in Yucatan, during the private excavations made before archaeological sites were controlled by the federal government, no Maya tomb with human remains has been found in the great city of Chichen Itza.

The city had a life lasting over many centuries, and its population was claimed to be in the hundred thousands, but no remains of its great men have ever been found.

In addition to investigating the site of the death's head terrace, the Mexican government will continue the restoration of the "Castillo", near which the terrace was discovered. The Castillo is the dominating structure in the entire city. It is a great pyramid with a stairway on each of its four steep sides leading up to the temple of the Maya Feathered Serpent God, Kukulkan, at the top.

At Teotihuacan, some thirty miles from Mexico City, a Toltec city whose story had been forgotten by the Aztec tribes which Cortez found there at the Conquest, excavations will be resumed about a group of buildings known as the "Subterraneos", where buildings of one epoch are superposed on those of another. Teotihuacan is the largest archaeological site now known, and investigations so far made show that there have been at least three distinct periods in the great city's history, when peoples of different cultures inhabited it long enough to leave their special style of remains.

Teotihuacan is characterized today by two great pyramids and a great sunken court surrounded by terraces topped with smaller pyramids, within which stands the "Temple of Quetzalcoatl". The city is oriented about a central axis, a wide avenue a mile and a third long, running slightly east of north and south. At the north end of this avenue is the "Pyramid of the Moon", so called because when the Spaniards came it still had its stone moon-god on top. To the east, and practically at the center of this avenue, is the still greater "Pyramid of the Sun", which used to have a stone idol of the sun god on top. The Pyramid of the Sun is a landmark for miles around the valley.

At the south end of the avenue, and also to the east, lies the great sunken court, surrounded by the pyramid-topped terraces. In the eastern half of the court, which resembles a giant athletic field, because steps like seats of bleachers run up from the ground to the terrace tops, is the pyramid called the Temple of Quetzalcoatl. The front of it is a simple Aztec style of structure, but when it was excavated it was discovered that it was merely added on to an older and much more ornate Toltec pyramid. This inner pyramid is noted for the grotesque stone carvings of Quetzalcoatl, the feathered serpent god of the Toltec.

The avenue, which is about one and a third miles long, is called the Pathway of the Dead, because it is bordered by a symmetrical arrangement of minor mounds which were first thought to be tombs. These, however, have been revealed to be only the substructures for buildings which have now for the most part disappeared.

In Tenayuca, six miles from Mexico City, a tunnel is being run through the Aztec pyramid there from west to east, to probe its structure and determine how many times it was enlarged. Tenayuca is both the most recently discovered and the most important Aztec site in the country because of the finds that have been made there. Studies now being made of thousands of pottery fragments from the pyramid excavations show that it was probably one of the earliest Aztec settlements in the valley. By the end of December, 1929, practically all the work at Tenayuca will be finished.

Eduardo Noguera and Ignacio Marquina, archaeologist and architect of the Mexican Direction of Archaeology, have left to explore the region between Zamora and Patzcuaro, in Michoacan, the center of the ancient Tarascan culture, a civilization which has never been systematically studied. They will select a suitable site for archaeological investigation.

The Tarascan race, like an island in the sea surrounded by more advanced cultures, appear to have remained more primitive than their neighbors, for reasons that have never been understood, or for which no satisfactory guess has even been made. Their idols and pottery remains, quite numerous in museums and private collections, and still being found by the old sites, have many of the characteristics of the early "archaic" people of Mexico, whose remains have been found from Tampico west to the northern part of South America. Among the Tarascans, whose geographic center was Michoacan, the archaic culture seems to have endured perhaps thousands of years after it had undergone radical evolution in other parts of Mexico.

Science News-Letter, November 9, 1929

Fawns Travel By Air

Zoology—Aviation

Airplanes are being used in restocking the south rim of the Grand Canyon with deer from the famous Kaibab herd on the north rim. Eight fawns were transported by airplane from Fredonia, Arizona, on the north side of the Grand Canyon, to Red Butte 95 miles away, on the south side. They had been brought the 16 miles from Pine Springs to Fredonia by truck, and completed the 17 miles from Red Butte to Grand Canyon village by the same mode of travel. Their combined air and truck journey was made in exactly three hours, whereas their predecessors of the last two or three years who made the entire trip by truck had to travel 240 miles and were from 24 to 30 hours on the road.

The new arrivals showed no ill effects from their pioneer air flight, and it remains to be seen whether they will high-hat their mere truck-riding predecessors.

The young deer were carried across the canyon in one of the Ford tri-motored airships in which the Scenic Airways Company has been carrying passengers on sight-seeing trips over the Grand Canyon during the past two summers. The seats were removed from the cabin of the plane to make room for the fawns, which had been placed in specially made individual crates.

Science News-Letter, November 9, 1929

Urge Study of American Medical History

Medical History

The first duty of the newly founded Department of the History of Medicine of the Johns Hopkins University will be to investigate the early medical history of our own continent, if the advice given at the dedication ceremonies by Prof. Karl Sudhoff of the University of Leipzig is followed.

Prof. Sudhoff is the greatest medical historian of our age, possibly of any age, and the high esteem in which he is held by Dr. William H. Welch, who will direct the new department, makes it likely that his advice will be followed.

The study of early American medicine will go back to the Incas, Mayas and Aztecs, whose ruined cities are now being investigated by archaeologists. All American and South American medicine, both ancient and modern, is an especially appropriate field for investigation by the new department, but this department's field is really world-wide, Prof. Sudhoff declared.

"A physician who knows only medicine, does not even know medicine," Prof. Sudhoff quoted, explaining that without historic perception the physician lapses into a mechanic. He also emphasized that an important phase of medico-historic investigation is its unifying function with reference to the basic disciplines and the many specialties of scientific medicine.

Dr. Welch himself, who is now professor of the history of medicine, believes that a study of medical history by periods is desirable. Also, he said that a knowledge of actual medicine, such as may be gained from actual practice, is of utmost importance before an attempt is made to write medical history. He attributed much of Prof. Sudhoff's own success as historian to the fact that he was a physician before he became a historian.

Because of the "tumultous" state of American universities today, the new department of history of medicine is particularly significant, Dr. Abraham Flexner of the General Education Board, pointed out. With the increased facilities of our universities has come simultaneously an increased cheapness and mechanization which is to be deplored. The new department or institute will lead a return to more cultural aspects of education, particularly along scientific and medical lines, where the emphasis now seems to be almost exclusively technical.

Science News-Letter, November 9, 1929

Medical Examinations for Students

Hygiene

Medical examinations with credits that count toward graduation should be added to school requirements, Dr. Francis E. Harrington, Minneapolis Commissioner of Health and Director of Hygiene, told members of the American Public Health Association at Minneapolis.

Health education and physical development are so important that they should be given the same weight as any other subject in the curriculum in Dr. Harrington's opinion. Children should be required to pass a medical examination as well as other examinations in order to graduate. Dr. Harrington demonstrated a card on which to record such an examination, and pointed out that standards to base the examination on must be set up.

Because the American people are fast becoming health conscious, opportunities for school health workers will be much better, prophesied Dr. Svon Lokrants, medical director of the Los Angeles city schools. Not only will they have a chance to do better work, but their salaries will be better, for people will realize that only the best in the profession should be employed and that these should be adequately paid.

Science News-Letter, November 9, 1929

Greek Art in Afghanistan

Archaeology

Some 6,000 statues and 500 shrines designed to hold the sacred relics of Buddha have been unearthed by the French during two seasons of archaeological exploration in Afghanistan. Though the subject is Buddhist the sculpture shows the unmistakable influence of classic Greek art at its best, according to J. Barthoux, in charge of the excavations.

Traces of Greek art have been found in Asia before dating from the time of Alexander's conquests but the masterly execution and number of the pieces can only be attributed, declared M. Barthoux, to the importation of Greek artisans on a large scale. The amazing variety of the racial types presented makes the collection of interest to ethnologists as well as classical students. A Greek Apollo is shown throwing flowers at the sacred Buddha while Scythian faces wear Phrygian caps, and Dante-like heads and figures might have been stolen from the stone carvings of some mediaeval cathedral.

Internal evidence apparently dates the collection after the time of the Seleucidae, the generals who divided up the empire of Alexander. The share of the statues which was due the French, according to the terms of the contract with the government of Afghanistan, is now housed in the Musée Guimet.

Science News-Letter, November 9, 1929

Undesirable fish are removed from streams in Germany by use of a strong electric current which stuns the fish, so that suckers and carp can be netted.

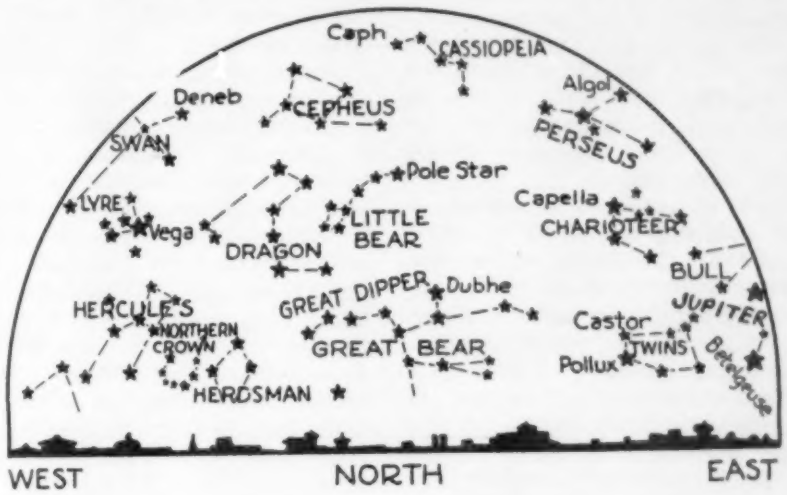
School children in Palestine are acting as sanitary inspectors to aid school nurses and the health department in raising the standards of public health.

Leonid Meteors Make Brilliant Display

Astronomy

By James Stokley

November is one of the two months of the year that are most famed for displays of meteors, or "shooting stars." On Thursday night, November 14, if you look to the northeastern sky at midnight you will see the familiar constellation of Leo, the lion, with the six stars forming the "Sickle". At this time the point of the sickle is uppermost and the handle extends to the south and downward. If the night is clear, your watching should soon be rewarded by the sight of a shooting star flashing from the center of the sickle. A few minutes more and you should see another one; then they should follow in fairly rapid succession.



These are the Leonid meteors, so called because of the constellation from which they seem to radiate. The astronomers are anxious to know how many of these meteors appear, during half-hourly intervals, and as one part of the country may be cloudy, amateurs are invited to aid in this work. All that you need to do is watch the sky, say from twelve to three a. m., and count the number of meteors that you see between twelve and twelve-thirty, twelve-thirty and one, etc. Dr. Charles P. Olivier, at the Flower Observatory of the University of Pennsylvania, in Philadelphia, Pa., is the leading meteor authority, and will be glad to receive any data from laymen.

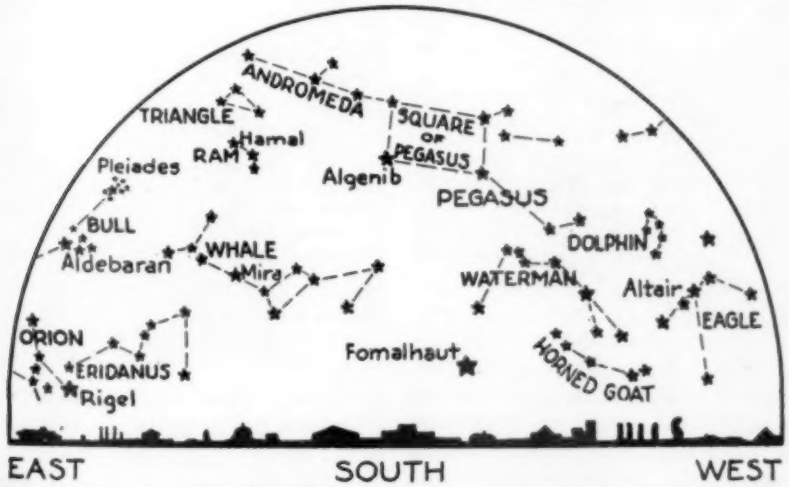
In 1833 and 1866, the Leonids were extremely numerous. Another such shower was expected in 1899 but did not materialize. The next couple of years, however, did bring an unusually large number of November meteors. It is thought that 1933 may bring another copious return of them, and if so, they should be getting more numerous now. On this account, observations are more needed now than they have been for some years.

Among the stars this month are some of the most interesting constellations in the sky. In one of them is the most distant object that can be seen with the unaided eye. This is the constellation of Andromeda, the Chained Lady. According to the ancient Greek mythology, Andromeda was the daughter of Cassiopeia, and was punished by being chained to the rock to be devoured by a sea-monster, because her mother had boasted of her beauty. She was rescued by Perseus. Holding the Medusa's head in front of him, he turned the sea-monster that threatened Andromeda to stone, and then rescued that fair lady from her plight.

To locate the constellation of Andromeda in the sky, it is best to start with Pegasus. The great square of Pegasus, shown on the map, is high in the southwest. The northeastern star of this square does not belong to the constellation of Pegasus, but to Andromeda. The other stars of the group run from this corner star, Alpheratz, to the northeast. Starting from Alpheratz, on a dark night, look along the line of bright stars to the third, then in a perpendicular direction to this line to the second of the two major stars. Near this major star, if your eyes are good and the night is dark and clear, you will see a faint hazy patch of light. It covers an area in the sky about the same as that of the full moon, but does not appear so large because it is so much fainter.

One might expect this light to be faint, however, because it is the oldest light that ever enters the unaided human eye, so far as we know. If you look at this spot tonight, the light from it that penetrates the lens of your eye and then shines on the retina, completes a journey that it has been taking for the last 900,000 years. When this light started, the human race had not yet appeared on the surface of the earth; in fact, it was nearly half-way across the intervening gap before our remotest human ancestors developed. During all this period it has been travelling at a speed of 186,000 miles per second, great enough to take us around the world in the seventh part of a second.

This object that we see by such an ancient light is known to astronomers as the Great Nebula of Andromeda. It is cer- (*Turn to next page*)



HOLD THESE MAPS in front of you and face North or South. The upper or lower one will then show the stars of the November evening sky

Leonid Meteors Make Brilliant Display—*Continued*

tain that it was known as far back as the year 905. The Arabian astronomer Al Susi described it as the "Little Cloud," before 986. On a Dutch star map published in 1500 it is also indicated. One of the earliest astronomers to use the telescope, Simon Marius, wrote that he first examined it with a telescope on December 15, 1612. This was just about two years after Galileo first looked at the stars through a telescope at all.

It remained for the much maligned "Gay Nineties" to reveal its chief characteristic. Nearly a century ago the Irish nobleman and amateur astronomer, the Earl of Rosse, discovered the first of the spiral nebulae. This is an object in the constellation of the hunting dogs, that looks like a celestial pin-wheel firework. With his great telescope, he also discovered several other spiral nebulae and introduced these interesting objects to astronomers. The object in Andromeda, however, did not appear spiral to him. During the nineties, another English astronomer, Sir Isaac Roberts, made the finest astronomical photographs that had been made up to his time. One of these was of the object in Andromeda and here it appeared for the first time with a spiral structure, showing that it, too, belonged to this rather large class of objects.

The true nature of the spiral nebulae was explained several years ago, after much controversy by astronomers, by Dr. Edwin P. Hubble of the Mt. Wilson Observatory in California. Using the great 100-inch telescope of the observatory, still the largest in the world but soon to be exceeded, he photographed the actual stars of which the Andromeda nebula consists. Just as the Milky Way appears to be a continuous band of hazy light to the naked eye, and is revealed by even such slight optical aid as a pair of opera glasses to be stars, so does the Andromeda nebula appear to be continuous in all but the very largest of instruments. Therefore, it was proved that it was a "universe" of stars, like our own, but beyond its limit. He was also able to measure its distance and found that it is 900,000 light years from us. A light year is equal to about six trillion miles. This is the nearest of a class of objects that have been called "island universes," but which are better designated by a name coined by Dr. Harlow Shapley, of the Harvard College Observatory, "galactons."

Following the line of bright stars from Alpheratz, a little beyond Andromeda, to the next constellation and then going a little to the south, one can locate the remarkable star Algol, in Perseus. This has long been known as the "Demon Star" because of its strange behavior. If you watch it night after night, you will find that on the evenings of Tuesday, November 12, Friday, November 15, and in the early morning hours of Sunday, November 10, and Saturday, November 30, it will be much fainter than at other times. For two days and eleven hours Algol remains of the same brightness, a little bit fainter than the second magnitude. Then in five hours it decreases to the 3.5 magnitude, and in another five hours returns to its normal state. The English astronomer, Goodricke, explained this mysterious behavior in 1782, when he suggested that the star was really double. One part of it, he said, is a bright body which we see, the other is a dark body which periodically revolves in front of the brighter one and partially eclipses it. Further studies since his time have shown the truth of his suggestion.

Whether on account of its variation, or not, Algol has long been associated with misery and misfortune. Its very name comes from the Arabic Al Ghul, meaning a mischief-maker, which is similar to the English word ghoul. The Chinese call it Tseih Sat, meaning the piled-up corpses. The Hebrews called it Rosh ha Satan, or Satan's head. On the old star map it represented the eye of the head of Medusa, which Perseus was carrying after he had slain her. It will be recalled, of course, that anyone who looked on Medusa's head immediately turned to stone, and Perseus caught her by watching her reflection in a polished shield.

A number of other bright stars are visible this month. Low in the northwestern sky is the constellation of Lyra, the lyre, containing the brilliant Vega. Directly west, about the same height above the horizon, is Aquila, the eagle, containing the brilliant Altair. Above Lyra is Cygnus, the swan, or Northern Cross, containing at the top of the cross, the first magnitude Deneb. Over in the eastern sky this month, one sees Orion, one of the most magnificent of all constellations, coming into view. The three, stars of Orion's belt are now upright in the eastern sky, a little to the south. To the north of the belt is the famous star Betelgeuse, which has as many different ways of pronouncing it as there are astronomers. To the south is Rigel. Above Orion is Taurus, the bull, with the red Aldebaran marking the bull's eye. Back of Taurus is Auriga, the charioteer, with Capella, another star of the first magnitude. Low in the southwest is Fomaulhaut, in Piscis Austrimus, the southern fish, one of the southernmost of all stars that we can see from this latitude. Jupiter is the most conspicuous planet in the evening sky during this month. On the 15th it will rise about 5.30 p. m., in the constellation of Taurus, and remain in view throughout the night. Its brilliancy, greater than that of any stars nearby, leaves no doubt as to its identity. Also, it shines with the steady light characteristic of the planets, and differing from the scintillation of the stars. Saturn has just about passed from view. It sets about two hours after the sun on the 15th, but is so low at twilight, that it will be hard to make out at all. In the morning sky, just before sunrise, Venus can be seen.

Science News-Letter, November 9, 1929

Aluminum chloride is now successfully used in making gasoline from high boiling petroleum oils.

When potatoes were introduced into Europe from America, alarmed citizens declared that eating potatoes would cause rheumatism, Bright's disease, and leprosy.

First Glances at New Books

THE THINKING MACHINE—C. Judson Herrick—*University of Chicago Press* ($3). With this challenging title as a text, Dr. Herrick proceeds in clear and orderly fashion to show what a machine really is and may be and what natural machines are like. The mechanistic view of human life expounded by this well-known physiologist may resolve many of the doubts of those who hesitate to think of man as a "machine," for we are told emphatically that such a view does not do away with choice, self-control, or the spiritual life, and a considerable portion of the book is devoted to psychology and human nature.

Physiology
Science News-Letter, November 9, 1929

THE MIND AT MISCHIEF—William S. Sadler—*Funk and Wagnalls* ($4). Few people who suffer from nerves and emotional conflicts understand to what extent they are the victims of intrigue and malicious deception on the part of their own minds, Dr. Sadler declares. Taking up one by one various abnormalities, he proceeds to explain how to recognize signs of trickery on the part of the mind, and how to put up a winning fight for self-mastery. The more serious mental diseases are not considered in this book, which deals with the "more or less abnormal" psychology of obsessions, fears, and other "complexes", emotional conflicts, hysteria, and simple paranoia.

Psychology
Science News-Letter, November 9, 1929

ADOPTION AMONG THE GUNANTUNA—Joseph Meier—*Publ. Cath. Anthropol. Conf.* We may rate the "little brown brother" as a simple and primitive soul, but he is bepestered with the same problems of surplus population and birth control that we are. This brochure tells how one tropical tribe endeavors to meet them.

Anthropology
Science News-Letter, November 9, 1929

CARE AND DISEASES OF TROUT—H. S. Davis—*Department of Commerce Document 1061* (15c). This pamphlet will be useful to all those who are engaged in the growing business of rearing trout for restocking our streams, and to zoologists generally.

Ichthyology
Science News-Letter, November 9, 1929

AMERICAN MESOZOIC MAMMALIA—G. G. Simpson—*Yale University Press* ($5). Back in the days when the earth was ruled by a heavy aristocracy of dinosaurs, there dodged among the thick underbrush, keeping out of their betters' way, a population of the meek who were ultimately to inherit the earth. These were the lowly beginnings of the mammalia, who still bore in teeth and limb reminders of their own reptilian origin. In this volume of the Memoirs of the Peabody Museum, Dr. Simpson gathers together all available data about such of these little known but highly important creatures as lived in America, and makes it conveniently accessible to students of ancient animal life.

Paleontology
Science News-Letter, November 9, 1929

HANDBOOK OF PALEONTOLOGY FOR BEGINNERS AND AMATEURS: PART I, THE FOSSILS—Winifred Goldring—*New York State Museum Handbook.* ($1.50). This is a compact little book that can be carried into the field in one's pocket, yet it contains in clear and well-arranged form all the information needed by the beginning student in paleontology. The text is reinforced by numbers of excellent line drawings.

Paleontology
Science News-Letter, November 9, 1929

GLACIAL GEOLOGY AND GEOGRAPHIC CONDITIONS OF THE LOWER MOHAWK VALLEY—A. P. Brigham—*New York State Museum Bulletin* ($1.50). Students of the glacial geology of New York, and of the modern geographic phenomena resulting therefrom, will welcome the completion of this work.

Geology
Science News-Letter, November 9, 1929

THE SAND AND GRAVEL RESOURCES OF NEW YORK STATE—C. M. Nevin—*New York State Museum Bulletin* ($1). Of interest to the building industries of the state, and to economic geologists in general.

Geology
Science News-Letter, November 9, 1929

IFUGAW VILLAGES AND HOUSES—Francis Lambrecht—*Publ. Cath. Anthropol. Conf.* (50c). A close study of the building methods of an interesting Filipino tribe.

Anthropology
Science News-Letter, November 9, 1929

Infantile Paralysis

Public Health

The period for the lowest level of infantile paralysis cases is approaching, the U. S. Public Health Service announces. From the first of December until the first of June about one case of the disease per 100,000 population will occur, health officials prophesy.

During the second six months of every year, from June 1 to December 1, from four to fourteen cases occur per 100,000 population. The greatest incidence is reached in mid-September when an average of two cases in three weeks per 100,000 occurs. Ever since the big epidemic of 1916, the month of June has been a time of special vigilance on the part of public health officers, who watch with concern a definite rise that occurs every year.

The measures through which might be expected a real diminution of incidence are those which diminish human contacts in general, but the drastic closing of all places of assembly is justifiable only with a very high incidence of, say, five or ten times the usual, and even in such a case the long incubation period would make it likely that in a restricted community the actual spread of the infection had begun to diminish before the alarm was sufficient to resort to such extremes.

Fewer cases of the disease occur in the warmer parts of the United States, but the seasonal distribution is about the same, proportionately, as it is in the North.

Science News-Letter, November 9, 1929

Washing Mosquito Eggs

Entomology

Washing mosquito eggs with soap and water and rinsing them in alcohol would seem to most housewives an unnecessary stretching of the laundry problem. Yet these measures were resorted to in the interests of science by Malcolm E. Macgregor, working at the Field Laboratory of the Wellcome Bureau of Scientific Research at Wisley, Surrey, England.

Mr. Macgregor's interest in the great unwashed of mosquitodom was aroused when he studied the problem of why mosquito larvae as scientists call them grow only in water that has a certain degree of acidity or alkalinity.

Science News-Letter, November 9, 1929

Although more than 21 miles of the Carlsbad Cavern, in New Mexico, have been explored, its size is still a matter of conjecture.

Scientific Ape Colony

Zoology

The great apes, man's nearest relatives in the zoological world, will be reared under conditions as near to nature as possible on a new 200-acre laboratory station to be established by Yale University near Orange Park, Florida. The great scientific "ape farm" has been made possible by a gift of $500,000 from the Rockefeller Foundation.

Old-World medical, zoological and psychological students have for some years had an opportunity to study apes under favorable climatic conditions at the great French station at Kindia, in Africa; but this will represent the first chance for American scientists to work with these animals with adequate facilities and unhampered by the unnatural environment inevitable in zoological gardens in the northern United States.

A group of scientists from other institutions are cooperating in the plans for the new station. These include, in addition to the Yale representatives, Prof. Edwin G. Conklin of Princeton University; Dr. Milton J. Greenman, of the Wistar Institute, Philadelphia; Prof. Theobald Smith, of the Rockefeller Institute; Dr. Clark Wissler, of the American Museum of Natural History, New York; Dr. H. Gideon Wells, of the University of Chicago, and Dr. John C. Merriam, president of the Carnegie Institution of Washington. This group will also serve as an advisory board for the general supervision of the program of the station, which it is planned to conduct in such a manner as to make it helpful to all university and scientific agencies working in the field of its interests.

Science News-Letter, November 9, 1929

Child Ills Increase

Medicine

A normal increase in the number of cases of scarlet fever and diphtheria throughout the country has been reported to the U. S. Public Health Service. At this season such an increase in the prevalence of these two diseases is expected, health officials explained.

So far the number of cases reported for each of these diseases is below the number reported for each at this time last year. State and city health departments in some parts of the country are making intensive efforts to have all children given inoculations of toxin-antitoxin to protect them from diphtheria.

Science News-Letter, November 9, 1929

Roman Statues Found in German Wall

Archæology

The foundation of a wall, consisting almost wholly of sculptured stones of the imperial Roman period, is the astonishing spoil of the spades of German archæologists working in the neighborhood of the town of Alzey in the Rhine country. Seeking for traces of a medieval church, they came upon the remains of a much older building, about sixteen yards square, which dates back to the days when the legions still occupied the parts of Germany that bordered upon Gaul.

The construction of the foundation was of most unusual type of masonry. The stones consisted largely of sculptured fragments of ancient pagan shrines and temples, including among others, nine altars, twenty-five pieces of pillars, four stones with inscriptions, six broken statues and reliefs, and six blocks with images of gods on all four sides. The structure suggests that it was the work of builders who not only disbelieved in the old gods but were actually hostile to them and wished to show their contempt for them; therefore possibly of early Christian date.

An examination of the sculptures and inscriptions shows that here, as elsewhere in southern Germany, the pre-Christian populace of mixed Germans, Romans and Gauls identified local gods with deities of the Roman pantheon. Apollo was linked with Grannus, a Celtic divinity, and the Roman Vulcan with the Celtic Cerunnos. Jupiter is shown with a nine-spoked wheel; and the wheel is not a Roman emblem but a German, being a figure of the sun. Dr. Friedrich Behn, curator of monuments at Mainz, who writes of the new discoveries in the German scientific journal *Forschungen und Fortschritte*, calls attention to the wheel which still figures in the coat-of-arms of his city. Mainz was once "Mogontiacum," the city of the sun-god Mogo. The wheel in the old sculpture identifies Jupiter of Rome with the local sun-god.

Science News-Letter, November 9, 1929

The discovery that rats are afflicted with a disease which appears to be the same as human leprosy may make it easier for scientists to make experimental studies of this dread disease.

CLASSICS OF SCIENCE: The Calculus of Probabilities

Mathematics

In this lecture, Laplace brings together the principles of one of the most fascinating departments of applied mathematics.

PART ONE

A PHILOSOPHICAL ESSAY ON PROBABILITIES. By Pierre Simon, Marquis de Laplace. Translated from the sixth French edition by Frederick Wilson Truscott and Frederick Lincoln Emory. New York, 1902.

General Principles

First Principle.—The first of these principles is the definition itself of probability, which, as has been seen, is the ratio of the number of favorable cases to that of all cases possible.

Second Principle.—But that supposes the various cases equally possible. If they are not so, we will determine first their respective possibilities, whose exact appreciation is one of the most delicate points of the theory of chance. Then the probability will be the sum of the possibilities of each favorable case. Let us illustrate this principle by an example.

Let us suppose that we throw into the air a large and very thin coin whose two large opposite faces, which we will call heads and tails, are perfectly similar. Let us find the probability of throwing heads at least one time in two throws. It is clear that four equally possible cases may arise, namely, heads at the first and at the second throw; heads at the first throw and tails at the second; tails at the first throw and heads at the second; finally, tails at both throws. The first three cases are favorable to the event whose probability is sought; consequently this probability is equal to ¾; so that it is a bet of three to one that heads will be thrown at least once in two throws.

We can count at this game only three different cases, namely, heads at the first throw, which dispenses with throwing a second time; tails at the first throw and heads at the second; finally, tails at the first and at the second throw. This would reduce the probability to 2/3 if we should consider with d'Alembert these three cases as equally possible. But it is apparent that the probability of throwing heads at the first throw is ½, while that of the other cases is ¼, the first case being a simple event which corresponds to two events combined: heads at the first and at the second throw, tails at the second. If

PIERRE SIMON, Marquis de Laplace

we then, conforming to the second principle, add the possibility ½ of heads at the first throw to the possibility ¼ of tails at the first throw and heads at the second, we shall have ¾ for the probability sought, which agrees with what is found in the supposition when we play the two throws. This supposition does not change at all the chance of that one who bets on this event; it simply serves to reduce the various cases to the cases equally possible.

Third Principle.—One of the most important points of the theory of probabilities and that which lends the most to illusions is the manner in which these probabilities increase or diminish by their mutual combination. If the events are independent of one another, the probability of their combined existence is the product of their respective probabilities. Thus the probability of throwing one ace with a single die is 1/6; that of throwing two aces in throwing two dice at the same time is 1/36. Each face of the one being able to combine with the six faces of the other, there are in fact thirty-six equally possible cases, among which one single case gives two aces. Generally the probability that a simple event in the same circumstances will occur consecutively a given number of times is equal to the probability of this simple event raised to the power indicated by this number. Having thus the successive powers of a fraction less than unity diminishing without ceasing, an event which depends upon a series of very great probabilities may become extremely improbable. Suppose then an incident be transmitted to us by twenty witnesses in such manner that the first has transmitted it to the second, the second to the third, and so on. Suppose again that the probability of each testimony be equal to the fraction 9/10; that of the incident resulting from the testimonies will be less than ⅛. We cannot better compare this diminution of the probability than with the extinction of the light of objects by the interposition of several pieces of glass. A relatively small number of pieces suffices to take away the view of an object that a single piece allows us to perceive in a distinct manner. The historians do not appear to have paid sufficient attention to this degradation of the probability of events when seen across a great number of successive generations; many historical events reputed as certain would be at least doubtful if they were submitted to this test.

In the purely mathematical sciences the most distant consequences participate in the certainty of the principle from which they are derived. In the applications of analysis to physics the results have all the certainty of facts or experiences. But in the moral sciences, where each inference is deduced from that which precedes it only in a probable manner, however probable these deductions may be. the chance of error increases with their number and ultimately surpasses the chance of truth in the consequences very remote from the principle.

Fourth Principle. — When two events depend upon each other, the probability of the compound event is the product of the probability of the first event and the probability that, this event having occurred, the second will occur. Thus in the case of the three urns A, B, C, of which two contain only white balls and one contains only black balls, the probability of drawing a white ball from the urn C is 2/3, since of the three urns only two contain balls of that color. But when a white ball has been drawn from the urn C, the indecision relative to that one of the urns which contain only black balls extends only to the urns A and B; the probability of drawing a white ball from the urn B is ½; the product of 2/3 by ½, or 1/3, is then the probability (*Turn to next page*)

Calculus of Probabilities—*Continued*

of drawing two white balls at one time from the urns B and C.

We see by this example the influence of past events upon the probability of future events. For the probability of drawing a white ball from the urn B, which primarily is 2/3, becomes ½ when a white ball has been drawn from the urn C; it would change to certainty if a black ball had been drawn from the same urn. We will determine this influence by means of the following principle, which is a corollary of the preceding one.

Fifth Principle.—If we calculate *à priori* the probability of the occurred event and the probability of an event composed of that one and a second one which is expected, the second probability divided by the first will be the probability of the event expected, drawn from the observed event.

Here is presented the question raised by some philosophers touching the influence of the past upon the probability of the future. Let us suppose at the play of heads and tails that heads has occurred oftener than tails. By this alone we shall be led to believe that in the constitution of the coin there is a secret cause which favors it. Thus in the conduct of life constant happiness is a proof of competency which should induce us to employ preferably happy persons. But if by the unreliability of circumstances we are constantly brought back to a state of absolute indecision, if, for example, we change the coin at each throw at the play of heads and tails, the past can shed no light upon the future and it would be absurd to take account of it.

Sixth Principle—Each of the causes to which an observed event may be attributed is indicated with just as much likelihood as there is probability that the event will take place, supposing the event to be constant. The probability of the existence of any one of these causes is then a fraction whose numerator is the probability of the event resulting from this cause and whose denominator is the sum of the similar probabilities relative to all the causes; if these various causes, considered *à priori*, are unequally probable, it is necessary, in place of the probability of the event resulting from each cause, to employ the product of this probability by the possibility of the cause itself. This is the fundamental principle of this branch of the analysis of chances which consists in passing from events to causes.

This principle gives the reason why we attribute regular events to a particular cause. Some philosophers have thought that these events are less possible than others and that at the play of heads and tails, for example, the combination in which heads occurs twenty successive times is less easy in its nature than those where heads and tails are mixed in an irregular manner. But this opinion supposes that past events have an influence on the possibility of future events, which is not at all admissible. The regular combinations occur more rarely only because they are less numerous. If we seek a cause wherever we perceive symmetry, it is not that we regard a symmetrical event as less possible than the others, but, since this event ought to be the effect of a regular cause or that of chance, the first of these suppositions is more probable than the second. On a table we see letters arranged in this order, *Constantinople*, and we judge that this arrangement is not the result of chance, not because it is less possible than the others, for if this word were not employed in any language we should not suspect it came from any particular cause, but this word being in use among us, it is incomparably more probable that some person has thus arranged the aforesaid letters than that this arrangement is due to chance.

This is the place to define the word *extraordinary*. We arrange in our thought all possible events in various classes; and we regard as *extraordinary* those classes which include a very small number. Thus at the play of heads and tails the occurrence of heads a hundred successive times appears to us extraordinary because of the almost infinite number of combinations which occur in a hundred throws; and if we divide the combinations into regular series containing an order easy to comprehend, and into irregular series, the latter are incomparably more numerous. The drawing of a white ball from an urn which among a million balls contains only one of this color, the others being black, would appear to us likewise extraordinary, because we form only two classes of events relative to the two colors. But the drawing of the number 475813, for example, from an urn that contains a million numbers seems to us an ordinary event; because, comparing individually the numbers with one another without dividing them into classes, we have no reason to believe that one of them will appear sooner than the others.

From what precedes, we ought generally to conclude that the more extraordinary the event, the greater the need of its being supported by strong proofs. For those who attest it, being able to deceive or to have been deceived, these two causes are as much more probable as the reality of the event is less. We shall see this particularly when we come to speak of the probability of testimony.

Seventh Principle.—The probability of a future event is the sum of the products of the probability of each cause, drawn from the event observed, by the probability that, this cause existing, the future event will occur. . .

When the probability of a single event is unknown we may suppose it equal to any value from zero to unity. The probability of each of these hypotheses, drawn from the event observed, is, by the sixth principle, a fraction whose numerator is the probability of the event in this hypothesis and whose denominator is the sum of the similar probabilities relative to all the hypotheses. Thus the probability that the possibility of the event is comprised within given limits is the sum of the fractions comprised within these limits. Now if we multiply each fraction by the probability of the future event, determined in the corresponding hypothesis, the sum of the products relative to all the hypotheses will be, by the seventh principle, the probability of the future event drawn from the event observed. Thus we find than an event having occurred successively any number of times, the probability that it will happen again the next time is equal to this number increased by unity divided by the same number, increased by two units. Placing the most ancient epoch of history at five thousand years ago, or at 182623 days, and the sun having risen constantly in the interval at each revolution of twenty-four hours, it is a bet of 1826214 to one that it will rise again to-morrow. But this number is incomparably greater for him who, recognizing in the totality of phenomena the principal regulator of days and seasons, sees that nothing at the present moment can arrest the course of it. . . .

A budget for gambling will appear in Part Two next week.